plagioclase-augen-gneiss which the author calls a schistose granite-diorite. Its constituents are quartz, plagioclase, biotite, hornblende and orthoclase as its principal components, with garnet, sphene, zircon, apatite, muscovite and microcline as the accessories. The quartz is penetrated by rutile needles. Nearly all the rock's constituents show evidence of dynamic fracturing.

GEOLOGY AND PALEONTOLOGY.

Dawson on the Oscillations of the Behring Sea Region.—Among the recent contributions to a knowledge of the coasts of Behring Sea are the notes made by G. M. Dawson during an extended cruise in that region. His paper is supplementary to that of Dall's relating to the American shores and islands of Behring Seas, and gives, generally speaking, the general physographic features of the land to which the attention of the earlier writer was not directed. We quote the following extracts from his general remarks.

"Behring Sea is a dependency of the North Pacific, marked off from it by a bordering chain of islands like those which outline Okhotsk Sea and the sea of Japan. It differs from these two seas by reason of its connection to the north with the Arctic Ocean, and in the fact that while the whole eastern part of its extent is comparatively shallow, the profounder depths of the north Pacific (in continuation of the Tuscarora deep) are continued into its western part. The Aleutian Islands, regarded as a line of demarkation between the main ocean and Behring Sea, are analagous to the Kurile islands with Kamtschatka, and to the islands of Japan. As to the Commander Islands, though these appear to lie in the continuation of the arc formed by the Aleutians, they are separated by a wide and, so far as known, very deep stretch of ocean from the last of these islands, and it is wholly probable that they may represent an altogether independent local elevation analogous to that to which Saint Matthew and its adjacent islands are due.

"The western part of Behring Sea has as yet been very imperfectly explored with the deep-sea lead, but the following general facts may be gathered from the existing charts: The entire chain of the Aleutian Islands is bordered at no great distance to the south by abyssal depths of the Pacific. The whole western portion of the chain likewise

slopes rapidly down on the northern side into very deep water, exceeding 1,000 fathoms as far to the eastward as Unimak Island; but from the vicinity of Unimak pass (longitude 165° west) the depths to the north of the islands are consistantly less than 100 fathoms. Beginning near the Unimak pass, the edge of the hundred-fathom bank runs northwestward, passing to the west of the Pribilovs and Saint Matthew Island and meeting the Asiatic coast in the vicinity of Cape Navarin, in about north latitude 60°. Thus all parts of Behring Sea to the north and east of this line, together with Behring Straits and much of the Arctic Ocean beyond, must be considered physiographically as belonging to the continental plateau region and as distinct from that of the ocean basin proper, and there is every reason to suppose that it has in later geologic times more than once and perhaps during prolonged periods existed as a wide terrestrial plain connecting North America with Asia.

"In all probability this portion of the continental plateau is a feature much more ancient than the mountain range of which the outstanding parts now form the Aleutian Islands. This range, though to some extent due to uplift, as for instance in the case of Attu Island, is chiefly built up of volcanic material. Its eastern part, in the Alaskan peninsula and as far as the Unimak pass, must be regarded as having been built upon the edge of the old continental plateau. Its western part, though certainly the continuation of the same line of volcanism, runs off the edge of the plateau and rises distinctly from the ocean-bed.

"The available evidence goes to show that the submarine plateau of the eastern part of Behring Sea, together with much of the flat land of western Alaska, was covered by a shallow sea during at least the later part of the Miocene period, while the most recent period at which this plateau stood out as land is probably that at which, according to facts previously noted, the Mammoth reached the Pribilof Islands and Unalaska Island across it.

"Evidence has recently been obtained of an important factor in regard to late changes of climate in this region, in the observations of Mr. I. C. Russel, which show that the great mountain range of the Saint Elias Alps must have been entirely formed in Pliocene or post-Pliocene times. The crumpling and upheaval of the beds which now form this range must have relieved a notable and accumulating tangential pressure of the earth's crust, the result of which it is yet difficult to trace; but that it must have brought about extensive changes of level throughout the region over which this pressure was exerted seems certain, and I

am inclined to suppose that it may have had much to do with the great later Pliocene uplift and subsequent depression to which the British Columbian region appears to have been subjected.

"One of the most remarkable features connected with the Behring Sea region is the entire absence of any traces of general glaciation. Statements to the effect that Alaska, as a whole, showed no such traces were early made by Dall and concurred in by Whitney. The result of my later investigations in British Columbia and along the adjacent coasts have been to show that such original statements were altogether too wide; that a great Cordilleran glacier did exist in the western part of the continent, but that it formed no part of any hypothetical polar ice-cap, and that large portions of northwest America lay beyond its borders.

"Statements made by Mr. John Muir, in which he not only attributed every physical feature noted by him in Behring Sea to the action of glaciation, but even expressed the opinion that Behring Sea and Strait represented a hollow produced by glaciation, remained altogether unsupported. It might be unnecessary even to refer to them but for the fact that they relate to a region for which data on this subject from other sources are so small. No traces have been found of general glaciation by land-ice in the region surrounding Behring Sea, while the absence of erratics above the actual sea-line show that it was never submerged for any length of time below ice-encumbered waters.

"The facts, moreover, connect themselves with similar ones relating to the northern parts of Siberia in a manner which will be at once obvious to any student of the glacial period." (Bull. Geol. Soc. Am. Vol. 5, 1894.)

Green Pond Conglomerate.—In Darton's paper on the outlying series of Paleozoic rocks which occupy a narrow belt extending from the Archean highlands of New Jersey into Orange Co., New York occurs the following description of the Green Pond Conglomerate.

"The greatest development of this formation is in New Jersey, where it is continuous over a wide area, and gives rise to a number of prominent ridges. In New York there are three small outlying areas: Pine Hill, northeast of Monroe, and two small ridges west of Cornwall station. Throughout its course it consists of coarse, red conglomerates below, and buff and reddish quartzites above, and the characteristics of these members are uniform throughout. The conglomerates consist of quartz pebbles from one-half to two inches in diameter in greater part, in a hard, sandy, quartzitic matrix of dull red color. The proportion

of pebbles to matrix is usually large, but there is local variation in this regard. The pebbles are mainly well rounded, but some subangular ones occur. They are mostly all of quartz, and white or pinkish in color. No quartzite pebbles were observed. In this characteristic the Green Pond Conglomerate differs greatly from the Skunnemunk conglomerate, but otherwise they are very similar. The thickness of the Green Pond conglomerate varies. In New York there are not over 60 feet, but in New Jersey it will probably be found to average about 150 feet in its greatest development in Green Pond and Copperas Mountains. Owing to its extreme hardness and massiveness, it give rise to high, rocky ridges with precipitous slopes in greater part. Green Pond, Copperas, Kanouse and Bowling Green Mountains are the most prominent of these, and they occupy an area of considerable size in New Jersey. South of the south end of Green Pond Mountain west of Dover there are outliers of conglomerates and sandstones probably of this age, which are described by book in the 'Geology of New Jersey' 1868.

"In the vicinity of Cornwall Station the conglomerate lies on Hudson shales; Pine Hill, on Cambrian limestone, at least in part; in Kanouse Mountain, on slates possibly of Hudson age, northward, and on Cambrian limestone southward; in Green Pond, Copperas and Bowling Green Mountains it lies directly on the crystalline rocks. The contact with the crystalline rocks is exposed along the upper part of the eastern slopes of Copperas Mountain, and the surface is a relatively level one. Small enclosed areas of the crystallines are bared by erosion of the conglomerate along the two anticlinals south of Newfoundland, and I find that gneiss extends to within half a mile of the depot in the western flexure. Along the axis of the eastern flexure, gneiss extends to and under Green Pond and down the gorge of the outlet of the pond to the end of Copperas Mountain. Along these anticlinals no actual contacts were found, but from many exposures in its vicinity the relative eveness of the floor was clearly apparent. In the Bowling Green Mountain the conglomerate is wrapped around the northern end of a ridge of gneiss, but its contact relations were not observed.

"The age of the Green Pond conglomerate and quartzite is approximately the same as Shawangunk grit and Oneida conglomerate, and probably they also represent all or a portion of the Medina. They are, at any rate, the representatives of the great arenaceous sedimentation at the beginning of the Upper Silurian. The evidence of their position is mainly their intimate relation to the Helderberg limestone throughout and the fact that they overlie the Hudson shales in New York and

probably also in New Jersey. Throughout their course in New Jersey and in New York the upper quartzites grade into the Longwood red shales, and these into the Helderberg limestone, constituting a series which overlaps the Archean, the Cambrian limestone and the Hudson shales. This stratigraphic relation, as well as precise lithologic similarity, served to correlate the Pine Hill and Cornwall Station areas with those of the Green Pond region in New Jersey. The superposition on the Hudson shale is unquestionable in the Cornwall region, where the Green Pond, Longwood, Helderberg and other series present the full sequence. In New Jersey there are shales underlying the conglomerate along the east side of Kanouse Mountain near its northern end, but it is not as yet demonstrated that they are Hudson in age.

"The estimate of the total thickness by Merrill of 600 feet in the Newfoundland region is considerably too great. I find that the 500 foot cliff south of the station, on which his estimate is based, contains nearly 100 feet of crystalline rocks at its base, but probably a considerable portion of the original thickness of sandstone was removed from its summit. The formation appears to attain its greatest thickness at this locality, for the average amount is considerably less elsewhere.

"The name Green Pond Mountain conglomerate or series has been applied to the formation by Cook, Smock and others, and, although originally always used to include the Skunnemunk conglomerate, it is, I believe, an appropriate name, with proper restriction, for the Upper Silurian member. The "mountain" may be omitted to advantage, as Green Pond is a typical locality. It is not proposed at present to separate the quartzite under a distinctive name." (Bull. Geol. Soc. Am., Vol. 5, 1894.)

Notes on the Osteology of Zeuglodon cetoides.—Last November Mr. Charles Schuchert of the U. S. National Museum obtained for that institution portions of the skeletons of two Zeuglodons. These have since been "developed" and the bones thus brought to light promise to add some points of interest to our knowledge of this interesting form.

The lower jaw, like that figured by Müller, contained six molariform teeth, showing that the number of premolars plus molars should be given as five to six, and not limited to five, as in Nicholson and Lydekker's Manual of Palæontology. The jugals, although slender, are much heavier than in the toothed whales, and the hyoid was apparently like that of a Sirenian, the basihyal being rather broad and flattened, the ceratohyal, long, curved, expanded at its distal end, and

articulating directly with the basihyal and not through the interposition of a long cartilage. The first four cervicals are very curiously interlocked; the atlas gives off a process from its ventral surface which curves back to almost touch the axis; the spinous process of the axis overlies the atlas in front, and extends backwards until it nearly touches the spinous process of the fourth cervical, that of the third cervical being abortive. The fourth cervical sends down a long parapophysis. The dorsal vertebræ are apparently fourteen in number, and none appear to have been lost. The last three ribs have no tubercle and unite with the middle of the centrum by a large head; the 10th and 11th ribs have a small tubercle although articulating with the body of the vertebra; the fifth rib is remarkable for its great upward curvature; the second to seventh ribs are much swollen towards the distal extremities.

The scapula is thoroughly cetacean in shape, as well as in the length of the acromial and coracoidal processes. The humerus is, as figured by Müller, heavy at its proximal end and tapering rapidly towards the distal extremity; the radius and ulna are so articulated with one another and with the humerus, as to permit flexion and extension only; the olecranal process is large, wide and flat; the distal ends of radius and ulna are rough and their epiphyses may have been entirely cartilaginous; two or three small bones of irregular form are very likely carpals, and if so they too were largely cartilaginous. No traces of hind limbs have as yet come to light.

The regular articular posterior extremity of the first sternal segment has led Professor Cope to suggest that the animal was in the habit of rearing the front part of its body out of water, and this suggestion derives additional weight from the shape of the articular faces of the dorsals; they indicate that not only was there movement in the dorsal region from side to side, but up and down, and show that the intervertebral cartilages were very thick. Many of the lumbo-caudals have the faces slightly approximated dorsally, indicating considerable vertical movement in this region. The change from the short centra of the dorsals to the extremely elongate centra of the lumbo-caudals is very abrupt and the vertebral column doubtless terminated with equal abruptness, since vertebræ a long way from the head are very massive. A curious feature is the prominence of the anterior zygapophyses in the lumbo-caudal region, since the spinous process are from 8 to 12 inches apart. Above all one is struck with the small size of the head and thorax when compared with the posterior region of the body, and it would seem that the head must have had a busy time in order to capture sufficient food to sustain the huge tail.—F. A. Lucas.